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Hydrothermal Synthesis of a Novel Spinel Nickel-Cobalt Sulfide/Polypyrrole Nanocomposite for High-Performance Supercapacitors

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ABSTRACT

In this paper, Nickel-Cobalt Sulfide / Polypyrrole nanocomposite was succefully developed as a electrode for supercapacitors. $NiCo_2S_4$/PPy obtained by hydrothermal shows alow charge transfer resistance and high specific capacitance of 2554.88 F/g at a current density of 2.54 A/g and good cycle stability (81% capacitance retention after 2100 cycles at high scan rate 150 mV/s). The superior electrochemical performance can be attributed to the combined contribution of both component. The results demonstrate that the $NiCo_2S_4$/PPy nanocomposite is promising as electrode matrial for supercapacitors in energy storge.

Keywords: $NiCo_2S_4$, polypyrrole, nanocomposite, specific capacitance, supercapacitor

1. INTRODUCTION

Of the many available energy storage and conversion technologies, supercapacitors have received intense attentions due to high power density, fast dynamics of charge propagation and long life stability. Electrode materials for supercapacitors are categorized to three types: carbon materials, metal oxides and electronically conducting polymers. Unfortunately, most of metal oxides, carbon materials and conducting polymers suffer from the problems of poor electronic conductivity, low specific capacitance and cycling stability. In order to overcome these problems, the combination of conducting polymer with transition metal sulfide or metal oxide can be used. In this study, nanocomposite of polypyrrole and spinel-nickel-cobalt sulfide was synthesized by hydrothermal method as electrode material for supercapacitors.

2. Methods

In this study, nanocomposite of polypyrrole and spinel-nickel-cobalt sulfide was synthesized by hydrothermal method as electrode material for supercapacitors.

Surface morphology of nanocomposites was evaluated using scanning electron microscopy (SEM). Also, thermal gravimetric analysis, Energy-dispersive X-ray spectroscopy (EDX), porosity measurements (BET) and X-ray diffraction (XRD) was used to study the structure and composition of nanocomposites.